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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte WEN-SYAN LI and JIAN XU

Appeal 2016-004902
Application 12/758,597
Technology Center 2400

Before ST. JOHN COURTENAY III, THU A. DANG, and
LARRY J. HUME, *Administrative Patent Judges*.

COURTENAY, *Administrative Patent Judge*.

DECISION ON APPEAL

STATEMENT OF THE CASE

This is an appeal under 35 U.S.C. § 134(a) from the Examiner's Final Rejection of claims 1–20, which constitute all the claims pending in this application. We have jurisdiction under 35 U.S.C. § 6(b).

We affirm.

Invention

The disclosed and claimed invention on appeal relates to “service level agreement” (SLA) compliant placement of multi-tenant database

applications.¹ (Title, ¶ 6). Appellants' invention uses a genetic algorithm to incorporate SLA requirements into the placement optimization process. (Spec. ¶ 36). Appellants' "system 100 is capable of proposing 'best-available' placements of the tenants 104 to the servers 106, even when there is no known solution that matches all of the SLA requirements completely." (*Id.*; see also Fig. 1).

Representative Claim

1. A computer system including instructions recorded on a non-transitory computer-readable medium and executable by at least one processor, the system comprising:

 a placement manager configured to cause the at least one processor to determine a placement of each of a plurality of tenant databases with one of a plurality of servers, the plurality of tenant databases including original tenant databases and replicated tenant databases that are duplicated from the original tenant databases, wherein the placement manager includes:

 an input handler configured to determine constraints of a service level agreement (SLA) governing an association of the plurality of tenant databases with the plurality of servers, and configured to determine computational constraints associated with the plurality of servers, the constraints including SLA constraints specifying a premium class of tenants and a regular class of tenants associated with the plurality of tenant databases, the premium class having access to more replicated databases than the regular class;

 a chromosome² generator configured to generate a

¹ Appellants acknowledge "the concept of multi-tenancy, by itself, for hosted database applications, is well known." (Spec. ¶ 31).

² We note the claim term "**chromosome**" is a term of art used in the context of genetic algorithms. *Cf.* He, Col. 8, l. 49. *See also* He, col. 1, ll. 40–42: "genetic algorithms (GA) are well-known stochastic optimisation [*Br. sp.*] search methods which are based on a global search procedure."

plurality of chromosomes including first and second chromosomes identifying a potential placement of each of the plurality of tenant databases with two or more of the plurality of servers and with the premium class having access to more replicated databases than the regular class, the second chromosome identifying at least one of the plurality of servers in failure;

a chromosome comparator configured to compare each of the plurality of chromosomes based on compliance with the SLA constraints and relative to the computational constraints, and configured to evaluate each of the plurality of chromosomes for fault tolerance specified in terms of the at least one of the plurality of servers in failure relative to the potential placement of each of the tenant databases associated with the premium tenants as compared to the potential placement of each of the tenant databases associated with the regular tenants, to thereby output a selected subset of the plurality of chromosomes;

a chromosome combiner configured to combine chromosomes of the selected subset of the plurality of chromosomes to obtain a next generation of chromosomes for output to the chromosome comparator and for subsequent comparison therewith of the next generation of chromosomes with respect to the SLA constraints and the computational constraints, as part of an evolutionary loop of the plurality of chromosomes between the chromosome comparator and the chromosome combiner; and

a placement selector configured to monitor the evolutionary loop and to select a selected chromosome therefrom for implementation of the placement based thereon.

(n.2 cont'd) *See* Appellants' Spec. ¶ 36: "In particular, the system 100 may implement a randomized algorithm approach known as a **genetic algorithm** (GA), which refers generally to a computer simulation of Darwinian natural selection that iterates through successive generations to converge toward the best solution in the problem/solution space." *See also* Spec. ¶ 38: "In the system 100, the above-referenced genetic algorithm approach may be implemented, for example, by creating a "**chromosome**" representing a possible solution to the problem" (emphasis added).

Rejections

R1. Claims 1–10 and 13–20 are rejected under 35 U.S.C. § 103(a) over the combined teachings and suggestions of Kwok et al. (US 2010/0077449 A1; pub. Mar. 25, 2010) (“**Kwok**”), Yemeni et al. (US 2010/0023564; pub. Jan. 28, 2010) (“**Yemeni**”), Karlsson³ et al. (US 7,000,141 B1; iss. Feb. 14, 2006) (“**Karlsson**”), Jia et al. (US 8,380,960 B2; iss. Feb. 19, 2013) (“**Jia**”), and in further view of **He** (US 7,593,905 B2; iss. Sept. 22, 2009).

R2. Claim 11 is rejected under § 103(a) as being unpatentable over the combined teachings and suggestions of Kwok, Yemeni, Jia, Karlsson, He, and in further view of **Sauermann** (US 2005/0177833 A1; Aug. 11, 2005).

R3. Claim 12 is rejected under § 103(a) as being unpatentable over the combined teachings and suggestions of Kwok, Yemeni, Jia, Karlsson, He, and in further view of Hebert et al. (US 8,301,776 B2; Oct. 30, 2012) (“**Herbert**”).

Grouping of Claims

Based on Appellants’ arguments (App. Br. 8–19), we decide the appeal of rejection R1 of claims 1–10 and 13–20 on the basis of representative claim 1. To the extent Appellants have not advanced separate, substantive arguments for the remaining dependent claims 11 and 12, rejected under Rejections R2 and R3, respectively, such arguments are considered waived. *See* 37 C.F.R. § 41.37(c)(1)(iv).

³ Karlsson is omitted in the rejection heading, but is applied against the claims in the body of the rejection. (*See* Final Act. 2, 8–11). We find this omission to be a typographical error by the Examiner.

ANALYSIS

We have considered all of Appellants' arguments and any evidence presented. We highlight and address specific findings and arguments for emphasis in our analysis below.

Rejection R1 of Representative Claim 1 under 35 U.S.C. § 103

Issue: Under § 103, did the Examiner err by improperly combining the cited references?

Appellants contend: “[t]he independent claims would not have been obvious on the combination proposed in the Final Office Action because combining Kwok with Yemeni, Jia, Karlsson and He in the manner proposed by the Final Office Action would have required **a change in the respective functions and/or principles of operation of, at least, Kwok, Yemeni and Karlsson.**” (App. Br. 13) (emphasis added).

Regarding specific references, Appellants contend:

Modifying Kwok to determine placement of application or middleware tenants by **iteratively and serially evaluating a set of trial solutions** under different failure scenarios, such as disclosed in **Karlsson** and proposed in the Final Office Action, would have required a change in the functions and/or **a change in the principle of operation of Kwok**. Again, the approach disclosed in **Kwok** *is based on an evaluation of available resources for multi-tenant applications at run time*. In the approach disclosed in Kwok, if available resources are insufficient, new application instances and/or servers are created. FN 18 (See Kwok, Fig. 7). Modifying Kwok in view of Karlsson, as proposed in the Final Office Action, *would have required a change in the function and/or a change the principle of operation of Kwok to use an iterative and serial evaluation of trial solutions under different failure scenarios rather than a determination of available resource at run time*.

(App. Br. 14) (emphasis added).

As described above, **Yemeni discloses a runtime approach** for replication of databases in response to run-time failures preventing access to instances of those databases. In Yemeni, if a run-time failure or resource limitation occurs that prevents access to a database, that database is replicated or migrated. (FN 19: *See e.g.,* Yemeni, Figs 3 and 4, paragraphs 0022-0027). **Modifying Yemeni to determine placement of database instances by serially and iteratively evaluating a population of trial solutions under different, potential failure scenarios, such as disclosed in Karlsson and proposed in the Final Office Action, would have required a change in at least this function and/or principle of operation of Yemeni.**

(App. Br. 15) (emphasis added).

Appellants contend the Examiner has relied on impermissible hindsight:

None of the applied references can be stitched together in the manner proposed in the Final Office Action without a set of detailed elements provided only by the present claims (and description) in **hindsight**, such as for at least the reasons discussed above. Specifically, the references in the proposed combination do not suggest or even permit the precise surgery set forth in the Final Office Action to meet the elements of the independent claims.

(App. Br. 17) (emphasis added).

Change in the Principal of Operation

At the outset, we find Appellants' "change in the principal of operation" argument is premised on the bodily incorporation of the features of the cited references. However, "it is not necessary that the inventions of the references be physically combinable to render obvious the invention under review." *In re Sneed*, 710 F.2d 1544, 1550 (Fed. Cir. 1983).⁴

⁴ The relevant inquiry is whether the claimed subject matter would have been obvious to those of ordinary skill in the art in light of the *combined teachings* of those references. *See In re Keller*, 642 F.2d 413, 425 (CCPA

Appellants emphasize “**Kwok** is based on an evaluation of available resources for multi-tenant applications at **run time**. (App. Br. 14, emphasis added.) Appellants further note: “**Yemeni** discloses a **runtime** approach for replication of databases in response to **run-time** failures preventing access to instances of those databases.” (App. Br. 15) (emphasis added).

We find Appellants’ “change in the principle of operation” argument is also premised on an erroneous assumption that the **runtime** approaches of Kwok and Yemeni would be incompatible with **Karlsson’s serial and iterative approach** that evaluates a population of trial solutions under different, potential failure scenarios, or with He’s teaching of using genetic algorithms to find optimal solutions to combinatorial problems. (See App. Br. 14–17).

Contrary to Appellants’ arguments, we find an artisan at the time of the invention would have known that computers routinely perform serial and iterative evaluations at runtime, i.e., in real time, on the order of thousands of instructions per second (kIPS), or even millions of instructions per second (MIPS), depending on variable factors such as CPU clock speed, cache or memory access speed, instruction types, execution order, and the presence of branch instructions, among other factors. Moreover, we find Karlsson describes an alternative embodiment that applies its analytical or simulation model to a “real distributed system” i.e., a real (physical) distributed system at runtime:

1981). See *KSR Int’l Co. v. Teleflex, Inc.*, 550 U.S. 398, 418 (2007) (the conclusion of obviousness can be based on the interrelated teachings of multiple patents, the effects of demands known to the design community or present in the marketplace, and the background knowledge possessed by a person having ordinary skill in the art.)

As mentioned, the method 200 may be performed on a real distributed system, as is illustrated in FIG. 1. Alternately, the method 200 may be performed on a model of the distributed system, such as an analytical model or a simulation model. Where the distributed system 100 is modeled, the model may be implemented, for example, by the computer system 400. A real system may then be constructed based on results using the model. The methods of FIGS. 2 and 3 may then be applied to the real system so constructed. In this way, the results based on the model can be verified and refined, as necessary, using the methods of FIGS. 2 and 3.

(Karlsson, col. 7, l. 59– col. 8, l. 3).

Similarly, we find no description in the He patent reference that precludes the use of genetic algorithms (implemented in code that is executed in real time on a physical computer) to solve problems in a runtime environment. The He patent reference expressly describes: “The invention is expected to find particular although not exclusive application in the fields of *load balancing* (e.g., *processor and network load balancing*), scheduling optimization (including production scheduling, resource assignments, timetable scheduling) and resource planning.” (He, Col. 1, ll. 15–20) (emphasis added). Similarly, Jia describes a system in which “[t]he allocation of users and their data may be balanced across storage in a distributed storage system.” (Col. 1, ll. 55–56).

Hindsight

Regarding Appellants’ hindsight argument, we are cognizant that our reviewing courts have not established a bright-line test for hindsight. In *KSR Int’l Co. v. Teleflex, Inc.*, 550 U.S. 398 (2007), the U.S. Supreme Court guides that “[a] factfinder should be aware, of course, of the distortion caused by hindsight bias and must be cautious of argument reliant upon *ex*

post reasoning.” *KSR*, 550 U.S. at 421 (citing *Graham v. John Deere Co. of Kansas City*, 383 U.S. 1, 36 (1966)). Nevertheless, the Supreme Court qualified the issue of hindsight by stating, “[r]igid preventative rules that deny factfinders recourse to common sense, however, are neither necessary under our case law nor consistent with it.” *Id.*

In reviewing the record, we find Appellants have not identified any knowledge relied upon by the Examiner that was gleaned only from Appellants’ disclosure and that was not otherwise within the level of ordinary skill in the art at the time of invention. *See In re McLaughlin*, 443 F.2d 1392, 1395 (CCPA 1971).

To the extent Appellants rely on *Mintz v. Dietz and Watson, Inc.*, 679 F.3d 1372 (Fed. Cir. 2012) (App. Br. 18), unlike in *Mintz*, here Appellants do not present any objective evidence of secondary considerations. Our reviewing court guides that evidence of secondary considerations “operates as a beneficial check on hindsight.” *Cheese Systems, Inc. v. Tetra Pak Cheese and Powder Systems, Inc.*, 725 F.3d 1341, 1352 (Fed. Cir. 2013).

Moreover, Appellants have not provided persuasive evidence that combining the respective teachings of the references (as proffered by the Examiner) would have been “uniquely challenging or difficult for one of ordinary skill in the art,” or that such a combination would have “represented an unobvious step over the prior art.” *Leapfrog Enters., Inc. v. Fisher-Price, Inc.*, 485 F.3d 1157, 1162 (Fed. Cir. 2007).

Therefore, in light of the above, and after reviewing the respective teachings and suggestions of the references (as cited by the Examiner, Final Act. 3–10), we find the Examiner provided sufficient articulated reasoning

with some rational underpinning to establish why an artisan would have been motivated to combine the references. (*Id.*)

Accordingly, on this record, and based upon a preponderance of the evidence, we are not persuaded the Examiner erred in combining the cited references. We therefore sustain the Examiner's rejection R1 of representative independent claim 1, and the grouped claims which fall therewith. *See Grouping of Claims, supra.*

Rejections R2 and R3

Appellants do not present substantive separate arguments regarding claims 11 and 12. Arguments not made are waived. *See* 37 C.F.R. § 41.37(c)(1)(iv). We therefore sustain the Examiner's rejections R2 and R3 of dependent claims 11 and 12, respectively.

DECISION

We affirm the Examiner's rejections of claims 1–20 under 35 U.S.C. § 103(a).

No time for taking any action connected with this appeal may be extended under 37 C.F.R. § 1.136(a)(1)(iv). *See* 37 C.F.R. § 41.50(f).

AFFIRMED